Bioterrorism: time to wake up

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Bioterrorism is a planned and deliberate use of pathogenic strains of microorganisms such as bacteria, viruses or their toxins to spread life-threatening diseases on a mass scale in order to devastate the population of an area. Bioterrorism is a major threat to mankind in future. In biological warfare there is a silent release of catastrophic biological agents, resulting in unrest in a population due to large-scale sufferings from diseases and disabilities. And this may lead to collapse of administration and governance. Microorganisms causing diseases like anthrax, plague, dengue, small pox, boutulism[1], have been grouped as bioterrorism agents of category A, due to their large-scale dissemination and high adverse public health impact. Category B includes typhus, brucellosis, cholera, etc. and these are easy to disseminate, but have low mortality rate. Bioterrorism agents of category C include pathogenic microbes that might be engineered for large-scale dissemination and high mortality rate, e.g. multiple drug-resistant tuberculosis strains[2]. Though there have been several incidents of bioterror in the past, the 2001 anthrax attack in the US focused on efforts to equip a country to counteract bioterrorist activity. During the same year, the then Deputy Chief Minister of Maharashtra received an envelope having anthrax culture[3]. The Pneumonic plague attack in 1994 at Surat is being suspected as an act of bioterrorism. In India, efforts have been put forward by DRDO agencies to develop counter measures against bioterrorism. A few laboratories of the DRDO are active in this area of research. To prepare for nuclear, biological and chemical warfare these laboratories have developed protective systems and equipment for troops. As India is a nation with a population of more than one billion, such efforts and R&D need to be strengthened further. Strategies should be in place to protect the population against the acts of bioterrorism. Terrorists outfits can use biological weapons and as these weapons strike suddenly without any warning, morbidity and mortality rate may be high. So we have to improve the response of our country towards biological attack.

To strengthen the area of biodefence, the US senate passed the ‘Bioterrorism Act of 2002’. According to this law, there is an essential element of national preparedness against bioterrorism and the focus is on safety of drugs, food and water from biological agents and toxins. However, we in India are still waiting for a law on bioterrorism.

In this context, we need to develop advanced detection systems against biological weapons, and in case the population is affected, prompt treatment methods should be facilitated. Forensic techniques should be strengthened to spot the origin of biological weapons and hazards associated with biological agents[4]. To prepare for an unannounced, unseen bioterrorist attack, our public health system should be up-to-date, with all possible facilities. Hospitals should be well equipped for emergency disaster management to provide medical aid at the time of outbreak of any infectious disease either due to natural causes or deliberate release of pathogenic microbes. Every wing of a hospital should participate in effective preparedness exercise for any emergency situation. Early detection and diagnosis of disease are critical factors to reduce the impact of an attack. So clinical awareness and education is important to prepare against bioterrorism. Clinical practitioners should update themselves regarding current infectious disease threats and causes, along with awareness regarding web-based alerting systems to incorporate relevant epidemiological information into their daily practice. Web sources (e.g. http://www.who.int/csr/don/en/, http://www.bt.cdc.gov, http://www.hpa.org.uk) can be used for self-learning, when formal face-to-face training programmes are not accessible[5]. Medical units should improve their existing infrastructure and infection control practices. Review of personal protective equipment (gloves, gowns, masks, respirators), wash rooms, waste-disposal arrangements, environmental hygiene and staff competency should be an integral part of everyday infection control. Our surveillance efforts and preparedness towards biowar should be fool-proof and methods of analysing the situation and data collection should be error-free and prompt. Surveillance department personnel should be in constant touch with the medical community to make the population of an area aware of the appropriate prevention and control strategies. Bioterrorism is a reality and the public should know about it. Apart from this, law enforcement is a must in our country. Laboratories and institution of R&D should follow some legal guidelines to store and work with pathogenic strains which may be used as bioweapons. It needs to be ensured that research organizations and individual researchers keep track of the whereabouts of dangerous pathogens, and handle and store them safely.

A country like India, where a large number of individuals suffer from communicable diseases, early detection of bioweapons may be a problem. Automated biosensors will not work due to constant and large prevalence of germs in the environment. Protective clothing for troops may not be helpful, as the main target of a biowar is population of a country. These are existing challenges for India to prepare for future biowars. Many suspect that attack of plague in Surat, dengue in Delhi and increase in multidrug resistance strains of TB in India may be acts of bioterrorism. We should have a national stockpile of drugs which are to be used against these biological agents. Personal awareness, readiness with drugs, and decontamination procedures are the fundamental steps towards our preparedness against a bioterrorist attack. Computer simulation models may be used to predict the staff and antibiotics requirement in case of a bioterrorist threat. In 2002, Hupert *et al.*[6] used one such model that simulates a patient’s interactions with the resources, i.e. beds and medical staff. On the basis of the number of the patients, the model predicts staff requirement and physical layout of the facilities like antibiotic distribution centres.

Another major concern is the postal services in India. How do we check the inflow of lyophilized pathogenic microorganisms through post? Do we have some detection parameters which are quick and cost-effective to screen out these letters having bioweapons? Delivery systems of bioweapons through letters, books and parcels make it easy for a bioterrorist to disseminate the germs throughout the environment. Bioterrorists can also use food as a vehicle for the biological, chemical or radiological agents. So food safety and security should be ensured by the public health system to avoid this sort of vulnerable situation. Rapid and dedicated food-testing laboratories should be developed. Registration of all the domestic and foreign food manufacturing and packing facilities should be done with the department of Food and Public Distribution System in India. The registration information can be vital to detect the origin of the problem during widespread food-borne diseases[7]. Thus, the strategies against bioterrorism involve prevention of an attack, detecting bioweapons, and quick relief in the event of biowar.

Premier research establishments in India should open up exclusive laboratories dedicated to the prevention of attack by bioterrorists. Scientists along with their work force should be specially trained in counter-defence activities. Because bioterrorism activity is not country- or region-specific, there may be spreading of diseases to larger areas. There should be global efforts and laws to avoid bioterrorism. Research is under way to formulate biochips, and advanced biosensors to detect biological agents and toxins, so that in the event of an outbreak, a fast-track response is put in place[8]. We should keep track of all these activities to prepare ourselves against bioterrorism, before it is too late.

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An appropriate season for conducting night blood survey for detecting microfilaria in Lymphatic Filariasis Elimination Programmes*

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Lymphatic filariasis (LF), a neglected parasitic disease, is one of the leading causes of morbidity, social stigma and economic loss in many tropical and sub-tropical countries[1]. More than a billion people are at risk in more than 80 countries. Over 120 million have already been affected by it; over 40 million of them are seriously incapacitated and disfigured by the disease. One-third of the global burden of LF infection lives in India, another one-third in Africa and the remaining distributed in South Asia, the Pacific and the Americas[2]. Although there have been significant advances in the diagnosis and detection of parasite, such as immunodiagnostics and ultrasound, no stage- and species-specific tools are available to detect the presence of active infection, intensity of infection or to discriminate between past and current infection[3]. Recently, it has been found that Og4C3 antigen testing could indicate the presence of the adult worm, and being a quantitative test, this could be applied as a prognostic marker[4]. However, in terms of simplicity and detection of transmission potential, the filariasis control programmes largely depend on detection and identification of microfilaria (Mf) in blood samples. Detection of microfilaria by finger prick during night-time is the standard and reliable method for detecting infection in the field, and also in the evaluation of control strategies for the control of LF[5].

Mf of nocturnally periodic *Wuchereria bancrofti* circulate between 1800 and 0600 h in the peripheral blood of an infected human and this is known as 'microfilarial periodicity'[6]. This coincides with the 'biting periodicity' of *Culex quinquefasciatus* as a vector of Bancroftian filariasis[7]. Thus the nocturnal periodicity of both the parasite and the vector mosquito facilitates the transmission of LF. The presence of human filarial infective larvae (L3) in vector mosquitoes indicates a need for the examination of blood samples from that locality for case detection[3]. Generally it is presumed that Mf are produced continuously by adult gravid worms of *W. bancrofti* round the year and can be detected in any month or season during the peak hours of microfilarial periodicity. Though the lifespan of microfilaria has been suggested to be 6–12 months[8], it is more frequently considered to be a couple of months[9,10], and to maintain the transmission; the vector should pick up these Mf within this period. After this period, the unpicked Mf may disappear from the peripheral blood and the fate of these Mf is not known.

The pre-patent period (from the entrance of L3 to the appearance of Mf in the peripheral blood) is estimated at about 9 months for *W. bancrofti* and the lifespan of adult worms is 5–10 years[11,12]. Also, information on the frequency, quantum and seasonality of Mf production by adult gravid worms of *W. bancrofti* is limited. In this context, it is logical to hypothesize that the production of Mf by gravid females of *W. bancrofti* synchronizes with the peak transmission months or the period just prior to it, when there is a high density of vector mosquitoes, thereby facilitating effective or successful infection and infectivity in them.

*The views expressed here are of the authors only and do not reflect the views of their institute.